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Cross-Section Analysis of Foodgrain Demand in a Low-Income Economy: The Case of Bangladesh

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1. Introduction

Rice has traditionally been the most important crop in Bangladesh and the staple food item for most of its population. Domestic production was complemented by considerable imports of rice and, in the sixties, also of wheat. Projections of the demand for foodgrain are therefore important for both short-and long-term planning.

The main econometric studies of demand for foodgrain in Bangladesh[1/] were based on the 1963-64 Survey of Household Income and Expenditure. Since then, results of two more recent surveys have become available. It is shown in this paper that the estimates of the demand functions obtained from these three samples are significantly different. A partial explanation of this result is that in a low-income economy households in different income classes react differently to changes in foodgrain availability or, equivalently, to changes in the (relative) foodgrain price.

The content of the paper is as follows. In the second section, a general description is given of the demand and supply of foodgrain in Bangladesh. The problems implicit in the estimation of demand for a staple crop in a low-income subsistence economy are discussed in the third section. In the following three sections, the demand functions to be estimated are specified, and the data, estimation techniques and tests are discussed. The results of the estimation and of the tests are then analyzed. Some conclusions are given in the last section.

1/ S. A. Abbas [1], S. Huq [4], and M. I. Khan [5].

2. The consumption of foodgrain in Bangladesh.

In the second half of the sixties, production of rice was about ten million ton. Wheat production, although on the rise, remained at less than 100,000 ton. Throughout the sixties, rice imports fluctuated between 250,000 and 500,000 ton (with the exception of fiscal year 1964-65, when they were lower). Wheat imports were increasing and reached a record level of 1,270,000 ton in 1969-70.

Domestically produced foodgrain was mostly marketed by private dealers. Local procurement by the government was of minor importance[2/]. On the other hand, the government had a monopoly on importing foodgrain and distributing it wholesale. Licensed dealers retailed this foodgrain on the basis of a rationing system controlled by the government. Rather small quantities of imported wheat were sold to private mills.

It is not clear to what extent the rationing rules were actually enforced. In an underdeveloped and densely populated area, enforcing rationing rules may be presumed to be extremely difficult. Probably a number of people got higher rations than allowed, some non-eligible people got rations, and retailers might in some cases have charged more than the retail rationing price set by the government.

2/ In the sixties, yearly procurement of local rice by the government amounted to less than 30,000 ton, except for fiscal years 1964-65 and 1965-66.

Neverthless, the rationing rules probably could not be evaded to such an extent that not these rules, but demand, based on income, relative prices and preferences determined the consumption of rationed foodgrain.

3. The Use of Cross-Section Data to Estimate Demand.

The three most recent econometric studies on demand for foodgrain (and for other food items) were based on the Survey of Household Income and Expenditure for 1963-64[3/]. Meanwhile, the results of two other surveys, for the years 1966-67 and 1968-69, have become available.

One can now ask whether estimation of demand functions from different samples gives approximately the same results. If this is not so, estimation results based on data from a sample for any specific year will provide only partial information on the demand function.

In a largely subsistence economy, in which food consumption levels are low by any standard, consumption of food items will follow closely production, especially when there are tight import controls. If production and imports show large fluctuations from year to year, the stability of the demand function presupposes that the consumption patterns of the different strata of the rural and the urban population (subsistence farmers, surplus farmers, landless labourers, traders, urban workers, the urban un- or partially employed, the middle and upper classes) are affected in the same way by changes in availability and simultaneous price changes.

3/ See footnote 1.

In this context it must be stressed that 1963-64 was characterized by a bumper rice harvest, whereas in the other two sample years rice production was below average[4/]. This is shown in table 1.

In the following discussion, estimates of the parameters of demand functions for foodgrain will be derived for each sample separately. The equality of the coefficients obtained from different samples will then be tested.

4. Specification of a Demand Function for Foodgrain in Bangladesh.

Under rationing, the problem facing the consumer may be formulated as that of maximizing a utility function, subject to a budget constraint and a number of rationing constraints, one for each rationed commodity[5/], i.e.

$$\text{maximize } u(q_1, \ldots, q_n) \tag{1}$$

$$\text{subject to } \sum_i p_i q_i = y \tag{2}$$

$$q_i \leq \bar{q}_i \qquad i = 1, \ldots, m < n \tag{3}$$

where q_i, p_i, and y stand for quantities and prices of commodities and for income, and the $\bar{q}_i$ are the rations for the m rationed commodities. If all rationing constraints are binding, the demand functions for non-rationed commodities are of the form

$$q_j = d_j\left(y - \sum_{i=1}^{m} p_i \bar{q}_i \; ; p_{m+1}, \ldots, p_n \; ; \bar{q}_1, \ldots, \bar{q}_m\right) \qquad j = m+1, \ldots n \tag{4}$$

4/ Average is determined as the trend value of production. Exponential trends were estimated using production series from 1950-51 to 1968-69 and from 1958-59 to the same final year. In both cases, the actual production figure for 1963-64 was considerably higher than the trend figures. For the other two years, the actual production was lower.

5/ For a survey of consumer theory under rationing, see Tobin [6].

TABLE 1.

Rice Production (million ton) and Price (Taka) in Sample Years.

	Actual Production	Trend I (1)	Trend II (2)	Rice Price (3)
1963-64	10.20	8.64	8.62	24.5
1966-67	9.20	9.55	9.85	35.7
1968-69	9.99	10.21	10.76	34.3

(1) Exponential trend estimated from time series for 1950/51 - 1968/69.

(2) Exponential trend estimated from time series for 1958/59 - 1968/69.

(3) Retail price per maund (82.29 lbs.) for medium quality, deflated by an index of food prices (exclusive of foodgrain) (1959-60 = 100).

Sources: rice production: L. Berlage, "Rice and Wheat Production and Consumption Statistics for Bangladesh", mimeo of the Center for Population Studies, Harvard University; rice price: Bangladesh Bureau of Statistics; index of food prices: our Calculations.

Rations enter the demand functions for non-rationed goods directly and through the income effect of rationing, whereas rationing prices enter only through this income effect. Similar demand functions cannot be derived for rationed commodities, with binding constraints, as in this case, the demand function collapses into the point $\bar{q}_i$. Therefore, in the Bangladesh context, the estimation of a demand function for wheat [6/], which was mainly distributed through the rationing system, has no economic meaning.

If one assumes that imported rice and wheat are perfect substitutes for local rice, and that the income effect of rationing commodities other than foodgrain is of minor importance, and if as an approximation, all wheat is assumed to be distributed through the rationing system, budget constraint (2) may be written

$$P_R c + \sum_{\substack{i \\ i \neq R,r,w}} p_i \bar{q}_i = y + (P_R - P_r)\bar{q}_r + (P_R - P_w)\bar{q}_w \qquad (5)$$

where the subscript R is used for local rice, r for imported rice, w for imported wheat, and where c is determined as

$$c = q_R + \bar{q}_r + \bar{q}_w \qquad (6)$$

If then the effect of prices and rations of other commodities on the demand for foodgrain is neglected, the demand function for foodgrain can be written

$$c = d\,[\bar{y} + (p_R - p_r)\bar{q}_r + (p_R - p_w)\bar{q}_w;\ p_R] \qquad (7)$$

6/ As was done by the authors mentioned in footnote 1.

As to the assumptions that were made in deriving this function, it is known that in Bangladesh local rice is generally preferred to imported rice and that rice is preferred to wheat. Moreover, as was discussed above, some wheat consumption comes from local production and a limited part of the wheat imports is not distributed through the rationing system. The imperfect substitutability of imported rice and wheat for local rice could be taken care of e.g. by multiplying $\bar{q}_r$ and $\bar{q}_w$ in equations (6) and (5) and p_R in the income terms in equation (7) by a constant or a suitable polynomial in $\bar{q}_r$, $\bar{q}_w$ and/or q_R. The problem with the available cross-section data is that they do not distinguish between the consumption of non-rationed and rationed rice and wheat. Therefore, rather than making some arbitrary assumptions about the proportions of rice and wheat consumption that come from rationing in each household income class, the substitutability assumption was retained as an approximation. For the same reason, the income effect of rationing in (7) was neglected. The function estimated thus was a simple demand function

$$c = d\,(y,\ p_R) \qquad (8)$$

Two specifications, both incorporating a declining income elasticity, were used:

$$c = \alpha_1 + \beta_1 \ln y + \gamma_1 p_R \qquad (8.1)$$

$$c = \alpha_2 + \beta_2 \frac{1}{y} + \gamma_2 p_R \qquad (8.2)$$

The income elasticity derived from the first function equals $\frac{\beta_1}{c}$ and that derived from the second one, $-\frac{\beta_2}{c.y}$ [7]. The second function therefore implies a faster-declining income elasticity of demand than the first one. If the function is estimated from data of one sample, only one observation on the price is available (unless differences in quality are taken into account). For estimation purposes, the price term will then collapse with the constant.

5. The Data[8]

The Surveys of Household Income and Expenditure were made by the Central Statistical Office of Pakistan for the years 1963-64, 1966-67, and 1968-69. For our purpose, the following relevant data are reported by household income class, for rural and urban areas separately[9]:

1. The number of households in the sample;
2. the sample population;
3. monthly income per household;
4. per capita consumption of rice and wheat.

7/ The use of a quadratic function resulted in higher SEE and lower t-statistics than functions (8.1) and (8.2).

8/ Data are given in appendix.

9/ Total income, rather than disposable income, was used because data on disposable income were not available for all samples. Available information indicates that the difference between the two variables is rather small, especially in low-income groups. The use of total income results in a downward bias of the estimated slope of the demand curve.

Per capita income is obtained from the first three series. Data for this variable were expressed in constant 1959-60 prices, using as deflator the Narayanganj consumer price index, complemented, for 1959-60 to 1961-62, by the Chittagong cost of living index[10/].

Data for rural and urban areas combined were derived by weighting the rural and urban data for each household income group by the sample population of the group. The proportion of the urban in the total population was higher for the sample than for the rural population. This should be kept in mind when estimation results derived from combined data are interpreted.

The rice price (retail price for medium quality, computed by the Bangladesh Bureau of Statistics) was deflated by a food (exclusive of foodgrain) price index, to eliminate the effects of inflation.

6. Estimation and Tests.

Separate estimates were obtained for rural and urban areas and for the two combined. Generalized least squares was used to estimate equations (8.1) and (8.2) from each sample and from the pooled data of the three samples. The variance-covariance matrix was specified as $\sigma \Lambda$, where the diagonal elements of Λ are the inverses of the sample population in each family income group, $1/h_{ij}$ (i refers to the sample, j to the household income group), and the other elements are zero.

10/ 1963-64: 114.04; 1966-67: 131.80; 1968-69: 140.52.

As already mentioned, the price coefficient can only be estimated from pooled data, unless quality differences are taken into account. The following test on the equality of the coefficients can then be made[11]. Let u_{ij}, $i = 1, \ldots, I$, $j = 1, \ldots, j_i$, represent the residuals of the equation estimated from sample i, and u_k, $k = I, \ldots, \sum_i J_i$, the residuals of the equation estimated from the data of several samples combined. Then it can be proved that[12]

$$\frac{\left(\sum_k u_k^2 - \sum_i \sum_j u_{ij}^2\right) / \left[2\,(I-1) - 1\right]}{\sum_i \sum_j u_{ij}^2 \;/\; \left(\sum_i J_i - 2\,I\right)} \qquad (9)$$

is distributed $F\left(2\,(I-1) - 1,\ \sum_i J_i - 2\,I\right)$.

7. Results

Regression results using combined data and rural and urban data separately are reported in Tables 2, 3 and 4. The income elasticities calculated from these results are given in Table 5.

11/ G. C. Chow [2], F. M. Fisher [3].

12/ Using Fisher's lemma 2.3 [3, p. 362] the A matrix when data from the three samples are pooled is defined as

$$\begin{bmatrix} 1 & 0 & p_{R1} \\ 0 & 1 & 0 \\ 1 & 0 & p_{R2} \\ 0 & 1 & 0 \\ 1 & 0 & p_{R3} \\ 0 & 1 & 0 \end{bmatrix}$$

where the subscripts 1, 2, 3 refer to the sample years.

Considering first the results obtained on the basis of individual samples, it appears that the inverse usually results in a lower standard error of regression. The major exceptions are the results obtained for 1966-67 for rural areas. The standard error of regression for the equations estimated from combined data is quite high, except for the inverse for 1963-64. Standard errors of regression for the equations estimated from rural and urban data separately are much lower, although some are still quite high. With a few exceptions the estimates of the coefficients are highly significant. It should be noted that the income elasticity of demand for foodgrain is apparently much lower in urban than in rural areas, a conclusion also reached in earlier studies.

We now turn to the discussion of the order of magnitude of the coefficient estimates. First, the amount of foodgrain that was available in each of the sample years is reported. As already mentioned, the 1963-64 rice harvest was higher than in any previous year and clearly higher than the trend figure (see Table 1). In 1966-67 and 1968-69, on the contrary, production was lower than the trend data. Moreover, the amounts of imported foodgrain that were distributed, although lower in 1963-64 than in the other two years, were not sufficiently different to make per capita availability of foodgrain in the last two sample years equal to that of the first one. This is confirmed by the sample data, which give an average monthly per capita intake of lbs. 29.58 for 1963-64, 28.25 for 1966-67 and 26.12 for 1968-69[13/].

13/ For rural areas, the figures were lbs. 30.55; 28.26 and 25.57, and for urban areas 28.61, 28.19 and 27.91. The difference in availability between 1966-67 and 1968-69 is rather large, if one assumes the production data to be correct.

TABLE 2

Results of Regression with Cross-Section Data: Bangladesh-Total

Year/ Functional Form	Constant (α)	Income Coefficient (β)	Price Coefficient (γ)	Standard Error of the Regression
1963-64				
a) Semilog	9.559	6.378		19.375
b) Inverse	37.174	-165.494		9.210
1966-67				
a) Semilog	-4.181***	10.438		23.087
b) Inverse	39.605	-241.311		12.497
1968-69				
a) Semilog	1.122***	8.443		38.614
b) Inverse	39.065	-252.906		24.734
Pooled Data: The 3 samples				
a) Semilog	7.010*	8.374	-.151	30.862
b) Inverse	43.170	-213.880	-.155	22.493
Pooled Data : 1966-67 and 1968-69 samples				
a) Semilog	-21.985***	9.583	.571***	31.736
b) Inverse	11.271***	-245.471	.800	19.223

Note : All coefficients are significant at 99% level except as mentioned below.

* significant at 95% level but not at 99% level

** significant at 90% level

*** not significant at the 90% level.

TABLE 3

Results of Regression with Cross-Section Data: Bangladesh - Rural

Year/ Functional Form	Constant (α)	Income Coefficient (β)	Price Coefficient (γ)	Standard Error of the Regression
1963-64				
a) Semilog	-1.615***	10.312		7.379
b) Inverse	40.758	-222.100		7.298
1966-67				
a) Semilog	-14.508	14.081		7.222
b) Inverse	42.236	-281.839		12.466
1968-69				
a) Semilog	-19.245	15.329		19.28
b) Inverse	43.595	-332.660		12.661
Pooled Data : The 3 Samples				
a) Semilog	-5.651*	13.026	-.176	18.789
b) Inverse	47.535	-270.331	-.184	19.154
Pooled Data : 1966-67 & 1968-69 samples				
a) Semilog	-41.905	14.555	.728	14.499
b) Inverse	10.869***	-299.887	.906	13.632

Note : See footnote to Table 2.

TABLE 4

Results of Regression with Cross-Section Data: Bangladesh -Urban

Year/ Functional Form	Constant (α)	Income Coefficient (β)	Price Coefficient (γ)	Standard Error of the Regression
1963-64				
a) Semilog	18.765	2.932		8.791
b) Inverse	32.189	-92.881		5.866
1966-67				
a) Semilog	13.508	4.388		12.349
b) Inverse	33.58	-140.751		9.415
1968-69				
a) Semilog	22.538	1.576*		8.222
b) Inverse	30.314	-66.694		7.146
Pooled Data : The 3 samples				
a) Semilog	20.020	2.976	-.058**	10.579
b) Inverse	34.248	-101.882	-.069*	8.447
Pooled Data : 1966-67 & 1968-69 samples				
a) Semilog	13.963***	3.040	.109***	11.559
b) Inverse	24.491*	-111.894	.221***	9.254

Note : See footnote to Table 2.

TABLE - 5

Income and Price Elasticity of Demand for Foodgrain : Bangladesh - Total, Rural and Urban

Year/ Functional Form	Total		Rural		Urban	
	Income Elasticity	Price Elasticity	Income Elasticity	Price Elasticity	Income Elasticity	Price Elasti -city
1963-64						
a) Semilog	.216		.338		.103	
b) Inverse	.212		.306		.102	
1966-67						
a) Semilog	.370		.498		.156	
b) Inverse	.355		.456		.158	
1968-69						
a) Semilog	.323		.600		.057	
b) Inverse	.396		.593		.073	
Pooled data : The 3 samples						
a) Semilog	.297	-.172	.467	-.204	.105	-.064
b) Inverse	.306	-.177	.433	-.214	.113	-.076
Pooled data : 1966-67 & 1968-69 samples						
a) Semilog	.352	.735	.541	.947	.108	1.360
b) Inverse	.372	1.030	.564	1.178	.124	2.758

Note : All elasticities are calculated at sample averages. In the c se of pooled data the non-weighted average of the sample averages was used.

As Tables 2-4 show the estimate of the income coefficient in the inverse function was in absolute value generally lower for 1963-64 than for the other two years. The only exception was the estimate derived from the urban data for 1968-69. Estimates of the same coefficient for combined and rural areas were, in absolute value, higher for 1968-69 than for 1966-67.

As for the semilog specification, the constant estimated for 1963-64 was higher than for the other two years and the income coefficient lower, the only exception again being urban 1968-69. The income coefficient estimate derived from the combined data, is higher for 1966-67 than for 1968-69; but for rural data the opposite is true, although the figures are quite close.

In short, the demand function estimated for 1963-64 was flatter than those estimated for other years. This was true in all cases except urban 1968-69. However, no such clear pattern arises from the comparison of the 1966-67 and 1968-69 estimates.

The relative magnitude of the income elasticities, derived from these estimates and reported in Table 5, shows a corresponding pattern. The elasticity for the combined data was lowest in 1963-64; the highest elasticity estimate was obtained for 1966-67 or 1968-69, depending on whether the semilog or the inverse specification is used. For rural areas, the 1963-64 figure is again lower than those for the other two years, but the highest elasticity is now obtained for 1968-69 with both specifications. Using the data for urban areas, the 1968-69 elasticity estimate is lowest.

One explanation is that peasants whose standard of living is close to subsistence, tend to adjust their consumption to their production of basic food items. Their reaction to changes in availability, or, in market terms, to prices, of these products will therefore differ from that of people in other income classes of living in different conditions.

This may explain the difference between the estimates obtained from rural data for 1963-64 and for the other two years. It does not explain the differences in the estimates of the demand function for urban areas. One may therefore have doubts about the quality of the sample data.

The equality of the coefficients for different years may be further analyzed using the Chow-test, described in section 6. This involves estimation of the demand function from pooled data and computation of F-statistics (9). Regression results are reported in Tables 2-4, elasticity estimates in Table 5, and the F-statistics in Table 6.

When data from the three samples are pooled, almost all coefficient estimates are significantly different from zero. As Table 6 shows, the equality of the coefficient estimates for the three samples was rejected in all cases at the 90% or higher confidence levels. Moreover, the equality hypothesis is rejected at much higher levels for the rural than for the urban samples.

When the 1963-64 sample is discarded, price coefficients estimated from the two remaining samples get the wrong sign[14/]. But typically the equality of coefficients, when combined and rural data are used, is rejected at considerably lower levels than both in the case where urban data are used and where rural data from the three samples are pooled.

The higher level of confidence with which the equality of coefficients is rejected for the three sample years when rural data are used, is in the line of our hypothesis. But the strong rejection of the equality hypothesis for estimates from urban data, especially when only the two last samples are pooled, is again unexpected.

8. Conclusions.

In this paper, demand functions for foodgrain in Bangladesh were estimated using observations from three different samples. Chow-tests rejected the hypothesis of equality of the coefficients for all three samples. One explanation is that subsistence peasants adjust their foodgrain consumption rather closely to their production. However, this explains only partially our results.

14/ This fact as well as the strange price elasticities (see Table 5) are explained by the fact that in the case of 2 samples, there are basically only two observations on prices.

Therefore the only definite conclusion that can be drawn from this study is that the available sample data do not provide definite evidence about the coefficients of the demand function for foodgrain in Bangladesh, and, consequently, about the income elasticity. Demand functions estimated from individual samples provide only partial information on these parameters. Moreover, as the hypothesis of equality of coefficients is rejected, there is no room for pooling data from different samples.

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TABLE A.1

Monthly Per Capita Consumption of Rice and Wheat by Household Income Groups Bangladesh[1] 1963-64, 1966-67, 1968-69 (in lbs.)

Monthly Income Groups (Rupees)	1963-64			1966-67			1968-69		
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total
All Groups	27.05	2.53	29.58	25.93	2.31	28.25	23.70	2.43	26.12
Less than 50	21.91	2.67	24.58	19.23	3.26	22.49	22.42	1.71	24.13
50 - 99	24.21	2.82	27.03	20.78	2.73	23.51	20.69	2.43	23.12
100 - 149	26.74	2.56	29.30	24.90	2.44	27.35	24.85	2.45	27.30
150 - 199	28.41	2.31	30.72	26.63	2.00	28.64	26.70	2.00	28.70
200 - 249	29.60	1.97	31.57	28.45	1.94	30.38	27.26	2.25	29.52
250 - 299	29.38	2.48	31.86	29.36	2.17	31.53	28.28	2.47	30.75
300 - 399	30.74	2.45	33.19	30.08	2.06	32.14	27.48	2.59	30.07
400 - 499	29.67	2.94	32.61	31.08	2.04	33.11	28.28	3.68	31.96
500 - 749				33.26	1.83	35.08	28.41	3.41	31.82
750 - 999		- See below -		31.46	2.52	33.97	24.89	3.81	28.70
1000 -1499				32.13	4.04	36.17	24.99	4.48	29.47
1500 -1999				18.20	3.85	22.05	21.60	4.07	25.67
2000 - above				30.07	1.19	31.22	27.77	2.06	29.83
(1963-64 figures:)									
500 - 699	29.32	2.93	32.25						
700 - 899	28.87	3.23	32.10						
900 - above	31.85	2.64	34.49						

(1) Weighted average (by sample population) of rural and urban data.

Source : Government of Pakistan, Central Statistical Office, Report of the Quarterly Survey of Current Economic Conditions in Pakistan, Household Income and Expenditure (July 1963- June 1964, July 1966-June 1967, July 1968-June 1969).

TABLE A. 2

Monthly per capita consumption of rice and wheat by household income groups, in rural areas of Bangladesh, 1963-64, 1966-67, 1968-69 (in lbs.)

Monthly Income Groups	1963-64			1966-67			1968-69		
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total
All Groups	28.74	1.81	30.55	26.68	1.58	28.26	23.84	1.73	25.57
Less than 50	22.07	2.30	24.37	19.40	2.86	22.26	22.20	1.71	23.91
50 - 99	24.66	2.51	27.17	20.88	2.47	23.35	20.59	2.16	22.75
100 - 149	27.93	1.81	29.74	25.77	1.69	27.46	25.43	1.93	27.36
150 - 199	29.93	1.54	31.47	27.54	1.23	28.77	27.79	1.15	28.94
200 - 249	31.82	1.17	32.99	29.81	1.13	30.94	28.70	1.42	30.12
250 - 299	31.86	1.56	33.42	31.27	0.97	32.24	29.39	1.63	31.52
300 - 399	33.74	1.40	35.14	32.87	0.78	33.65	29.56	1.73	31.29
400 - 499	32.50	1.58	34.08	34.54	0.76	35.30	33.14	1.95	35.09
500 - 749				35.96	0.31	36.27	32.79	1.19	33.98
750 - 999		- See below -		40.38	0.25	40.63	32.11	--	32.11
1000 -1499				39.74	1.56	41.30	35.85	3.52	39.37
1500 -1999				---	--	---	---	--	---
2000 - over				---	--	---	---	--	---
(1963-64 figures)									
500-699	34.04	1.87	35.91						
700-899	35.73	0.41	36.14						
900 - over	43.75	0.27	44.02						

Source : see Table A. 1

TABLE A. 3

Monthly per capita consumption of rice and wheat by household income groups, in urban areas of Bangladesh, 1963-64, 1966-67, 1968-69 (in lbs.)

Monthly Income Groups	1963-64			1966-67			1968-69		
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total
All Groups	24.56	4.05	28.61	23.33	4.86	28.19	23.24	4.67	27.91
Less than 50	21.27	4.11	25.38	17.11	8.23	25.34	28.80	2.06	30.86
50 - 99	22.61	3.81	26.42	20.02	4.69	24.71	21.80	5.04	26.84
100 - 149	23.90	4.28	28.18	21.70	5.23	26.93	22.22	4.71	26.93
150 - 199	24.40	4.28	28.68	23.04	5.06	28.10	22.89	4.88	27.77
200 - 249	25.20	3.52	28.72	23.96	4.59	28.55	23.35	4.51	27.86
250 - 299	25.06	4.07	29.13	23.99	5.55	29.54	24.83	4.34	29.17
300 - 399	26.54	3.89	30.43	24.91	4.44	29.35	23.78	4.14	27.92
400 - 499	26.41	4.46	30.87	25.84	3.97	29.81	23.74	5.31	29.05
500 - 749				28.45	4.83	32.98	25.36	4.96	30.32
750 - 999		- See below-		23.64	4.51	28.15	23.37	4.61	27.98
1000 - 1499				25.05	6.34	31.39	22.44	4.69	27.13
1500 - 1999				18.20	3.85	22.05	21.60	4.07	25.67
2000 - over				30.07	1.19	31.26	27.77	2.06	29.83
(1963-64 figures)									
500 - 699	25.24	3.89	29.13						
700 - 899	25.61	4.55	30.16						
900 - Over	26.60	3.68	30.28						

Source : see Table A. 1

TABLE A.4

Population and Monthly Per Capita Income of Sample Households by Monthly Household Income Groups : Bangladesh[1] 1963-64, 1966-67 1968-69

Monthly Income Groups (Rupees)	1963-64 Sample Households	1963-64 Sample Population	1963-64 Monthly Income per capita (Current Rs.)	1966-67 Sample Households	1966-67 Sample Population	1966-67 Monthly Income per capita (Current Rs.)	1968-69 Sample Households	1968-69 Sample Population	1968-69 Monthly Income per capita (Current Rs.)
All Groups	4299	23868	30.13	5977	31550	31.68	6208	30159	28.24
Less than 50	276	674	15.80	142	339	17.26	88	157	22.73
50 - 99	1208	4992	18.64	1876	7270	19.93	1615	5513	23.63
100 - 149	1150	6035	23.39	1565	7407	25.84	1793	7762	29.20
150 - 199	656	3961	28.76	944	5398	30.00	1207	6333	31.14
200 - 249	371	2515	32.73	553	3678	33.06	659	4014	36.15
250 - 299	213	1649	35.21	332	2401	37.43	343	2307	40.24
300 - 399	177	1532	39.52	288	2332	41.97	277	2135	43.95
400 - 499	105	989	47.29	117	1070	47.89	98	776	56.16
500 - 749				102	989	60.65	76	692	68.69
750 - 999				26	289	77.29	26	236	93.87
1000 - 1499		- See below -		26	305	98.00	18	184	126.45
1500 - 1999				4	46	142.33	5	30	285.50
2000 - above				2	26	268.61	3	.20	337.88
(1963-64 figures)									
500 - 699	76	775	56.24						
700 - 899	34	358	74.93						
900 - above	33	388	108.49						

(1) Weighted average (by sample population) of rural and urban data.

Source: See footnote to Table A.1

TABLE A. 5

Population and Monthly Per Capita Income of Sample Households by Monthly Household Income Groups : in Rural Areas of Bangladesh 1963-64, 1966-67, 1968-69.

Monthly Income Groups (Rupees	1963-64 Sample House-holds	1963-64 Sample Population	1963-64 Monthly Income per Capita (Current Rs.)	1966-67 Sample House-holds	1966-67 Sample Popula-tion	1966-67 Monthly Income per Capita (Current Rs.)	1968-69 Sample House-holds	1968-69 Sample Popula-tion	1968-69 Monthly Income Per Capita (Current Rs.)
All Groups	2952	16134	27.13	4689	24521	28.84	4823	23013	30.80
Less than 50	216	536	15.59	131	314	17.21	84	152	22.62
50 - 99	911	3833	18.37	1642	6404	19.62	1447	5002	22.90
100 - 149	794	4208	23.19	1275	5832	25.42	1439	6349	27.66
150 - 199	466	2819	28.62	730	4307	29.10	914	4901	31.93
200 - 249	247	1661	33.21	415	2522	32.61	470	2922	35.62
250 - 299	133	1047	34.61	239	1769	36.64	280	1582	39.35
300 - 399	95	686	37.00	176	1514	39.65	168	1368	41.73
400 - 499	45	525	38.85	65	644	44.02	41	377	48.57
500 - 749				57	633	54.25	23	284	49.25
750 - 999				10	135	61.59	4	41	82.23
1000 - 1499		- See below-		9	147	72.27	3	35	106.83
1500 - 1999				-	-	-	-	-	-
2000 - above				-	-	-	-	-	-
(1963-64 figures)									
500 - 699	29	357	46.68						
700 - 899	8	114	58.90						
900 - above	8	118	100.17						

Source: See footnote to Table A. 1

TABLE A.6

Population and Monthly Per Capita Income of Sample Households by Monthly Household Income Groups: in Urban Areas of Bangladesh 1963-64, 1966-67, 1968-69.

Monthly Income Groups (Rupees)	1963-64 Sample Households	1963-64 Sample Population	1963-64 Monthly Income Per Capita (Current Rs.)	1966-67 Sample Households	1966-67 Sample Population	1966-67 Monthly Income Per Capita (Current Rs.)	1968-69 Sample Households	1968-69 Sample Population	1968-69 Monthly Income Per Capita (Current Rs.)
All Groups	1347	7734	36.38	1288	7029	41.55	1385	7146	45.81
Less than 50	60	138	16.60	11	25	17.87	4	5	27.50
50 - 99	297	1159	19.52	234	866	22.21	168	511	27.41
100 - 149	356	1827	23.86	350	1575	27.38	354	1413	30.70
150 - 199	190	1113	29.12	214	1091	33.56	293	1452	34.86
200 - 249	124	854	31.97	133	856	34.56	189	1092	37.59
250 - 299	80	602	36.25	93	632	39.65	113	725	42.17
300 - 399	82	646	42.98	112	818	46.26	109	767	47.91
400 - 499	60	464	56.72	52	426	53.74	57	399	63.33
500 - 749				45	356	72.02	53	408	77.30
750 - 999				16	154	91.05	22	195	96.32
1000 - 1499				17	158	121.95	15	149	118.18
1500 - 1999				4	46	142.33	5	30	285.50
2000 - above				2	26	269.61	3	20	337.88
(1963-64 figures)									
500 - 699	47	418	64.38						
700 - 899	26	244	82.41						
900 - above	25	270	112.12						

Source : See footnote to Table A.1

TABLE B.2

Income Elasticity of Demand for Foodgrains (Rice and Wheat by Monthly Income Group : Bangladesh, Total Rural and Urban, 1963-64.

Monthly Income Group	Total		Rural		Urban	
	E_1	E_2	E_1	E_2	E_1	E_2
-- 50	.26	.49	.42	.67	.12	.25
50 - 99	.24	.37	.38	.51	.11	.21
100 - 149	.28	.28	.35	.37	.10	.16
150 - 199	.21	.21	.33	.28	.10	.13
200 - 249	.20	.18	.31	.23	.10	.12
250 - 299	.20	.17	.31	.22	.10	.10
300 - 399	.19	.14	.29	.19	.10	.08
400 - 499	.20	.12	.30	.19	.10	.06
500 - 699	.20	.10	.29	.15	.10	.06
700 - 899	.20	.08	.29	.12	.10	.04
900 +	.19	.05	.23	.06	.10	.03
All groups	.21	.22	.34	.31	.10	.10

Note : E_1 = Income elasticity of demand for foodgrains, obtained from the regression equation

$$c = \alpha_1 + \beta_1 \ln y$$

E_2 = Income elasticity of demand for goodgrains, obtained from the regression equation

$$c = \alpha_2 - \frac{\beta_2}{y}$$

TABLE B.2

Income Elasticity of Demand for Foodgrains (Rice and Wheat) by Monthly Income Group : Bangladesh, Total Rural and Urban, 1966-67

Monthly Income Group	Total		Rural		Urban	
	E_1	E_2	E_1	E_2	E_1	E_2
-- 50	.46	.82	.63	.97	.17	.41
50 - 99	.44	.68	.60	.81	.18	.34
100 - 149	.38	.45	.51	.53	.16	.25
150 - 199	.36	.37	.49	.44	.16	.20
200 - 249	.34	.32	.46	.37	.15	.19
250 - 299	.33	.27	.44	.31	.15	.16
300 - 399	.32	.24	.42	.28	.15	.14
400 - 499	.32	.20	.40	.24	.15	.12
500 - 749	.30	.15	.39	.19	.13	.08
750 - 999	.31	.12	.35	.15	.16	.07
1000 - 1499	.29	.09	.34	.12	.14	.05
1500 - 1999	.47	.10	-	-	.20	.06
2 000 +	.33	.04	-	-	.14	.02
All Groups	.37	.36	.50	.46	.16	.16

Note: E_1 = Income elasticity of demand for foodgrains, obtained from the regression equation

$$c = \alpha_1 + \beta_1 \ln y$$

E_2 = Income elasticity of demand for foodgrains, obtained from the regression equation

$$c = \alpha_2 - \beta_{\frac{2}{y}}$$

TABLE B.3

Income Elasticity of Demand for Foodgrains (Rice (Wheat) by Monthly Income Group: Bangladesh, Total Rural and Urban, 1968-69.

Monthly Income Group	Total		Rural		Urban	
	E_1	E_2	E_1	E_2	E_1	E_2
-- 50	.35	.65	.64	.86	.05	.11
50 - 99	.37	.65	.67	.90	.06	.13
100 - 149	.31	.45	.56	.62	.06	.11
150 - 199	.29	.40	.53	.51	.06	.10
200 - 249	.29	.33	.51	.44	.06	.09
250 - 299	.28	.29	.49	.38	.05	.08
300 - 399	.28	.27	.49	.36	.06	.07
400 - 499	.26	.20	.44	.27	.05	.05
500 - 749	.27	.16	.45	.28	.05	.04
750 - 999	.29	.13	.48	.18	.06	.03
1000 - 1499	.29	.10	.39	.11	.06	.03
1500 - 1999	.33	.05	-	-	.06	.01
2000 - +	.28	.04	-	-	.05	.01
All Groups	.32	.40	.60	.59	.06	.07

Note : E_1 = Income elasticity of demand for foodgrains, obtained from the regression equation

$$c = \alpha_1 + \beta_1 \ln y$$

E_2 = Income elasticity of demand for foodgrains, obtained from the regression equation

$$c = \alpha_2 - \frac{\beta_2}{y}$$